AEON January 2022
Cruise Report
M/V Warren Jr
4 – 13 Jan 2022
Boston, MA to Boston, MA

Photo credit: Jennifer Miksis-Olds

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Cruise Summary

The objectives for this cruise were to recover bottom landers at 3 sites (Table 1) in the Gulf of Maine (Figure 1), deploy 5 landers, collect CTD profiles to characterize hydrographic conditions at the sites, conduct net sampling to collect biological specimens at each site, and conduct fine-scale (roughly 5 n.mi by 5 n.mi) multi-frequency acoustic surveys at each site. Lander recovery was only planned at 3 of the 5 AEON sites because the lander deployments at AEON 1 (NEC) and AEON 2 (ECS) were not scheduled to be deployed in Canadian waters until Jan 2022. We were able to successfully recover all 3 of the landers deployed during AEON Cruise 2 in July 2021. The AEON 3 (GEB) and AEON 5 (WIB) landers were recovered on this cruise. The AEON 4 (JOB) lander did not surface after the acoustic releases were tripped even though the acoustic releases were communicating fine with the ship. This lander was recovered by a commercial fisherman hired by UNH to retrieve the AEON 4 (JOB) lander when it surfaced 4 days after the cruise ended. Rough weather conditions limited the ability to conduct net tows and fine-scale acoustic surveys at a number of AEON sites (Table 1). CTD casts and ring-net tows were obtained at all sites.

AEON site naming conventions were modified during this cruise to provide additional geographical information that a numerical system did not capture (Table 1: NEC=Northeast Channel, ECS=Eastern Coastal Shelf, GEB=Georges Basin, JOB=Jordan Basin, WIB=Wilkinson Basin. All the AEON site number identifiers will be retained, as these site numbers are identified in ONR environmental paperwork and approvals. The 3-letter geographical site information will be added to each site.

Station	Lat	Long
AEON1 NEC	42.30	-65.98
AEON2 ECS	42.84	-66.73
AEON3 GEB	42.62	-68.14
AEON4 JOB	43.81	-67.68
AEON5 WIB	42.87	-70.02

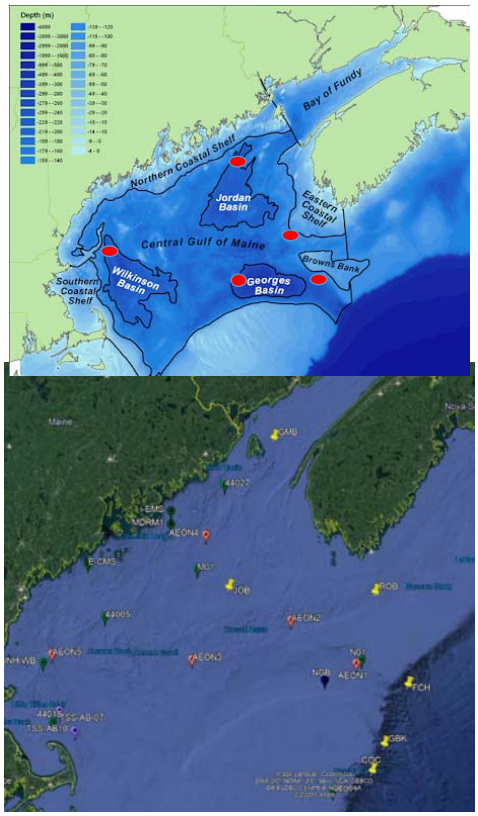

Figure 1. AEON lander locations. Image in the top right shows the AEON locations in reference to local basins and bathymetry. Image in the bottom right shows AEON locations in relation to other sampling platforms that do not include acoustics.

Table 1. Summary of sampling that occurred at each site location during the AEON Jan 2022 research cruise.

Site	Lander Recovered	Lander Deployed	CTD casts	Ring net tows	Fine-Scale Acoustic Survey
AEON 1 **NEC**		Yes	1	1	
AEON 2 **ECS**		Yes			
AEON 3 **GEB**	Yes	Yes	1	1	
AEON 4 **JOB**	Yes	Yes	1	1	
AEON 5 **WIB**	Yes	Yes	1	1	1

Ocean Bottom Landers

At all five sites, new landers were deployed. Lander deployment was performed via the A-frame, winch, and quick release. The lander was lifted and suspended over the aft of the vessel and then lowered into the water. Once the lander was fully submerged, the quick release was triggered, and the lander dropped. For each station, range measurements to the acoustic releases were taken at the four cardinal points around the lander approximately 500 m from the deployment site to calculate a more precise lander position on the seafloor. As the M/V Warren Jr's depth sounder was not accurate beyond 100 m, the depth was also calculated from these range measurements, therefore there is between 1 – 3 m error in the depth estimates in Table 2. Minimal equipment refurbishment (fresh batteries, o-ring inspection, cleaning, and data download) was required during the cruise, however, VEMCO's did require refurbishment at two sites and a Microcat CTD-ODO at one site.

Table 2. Table: Lander deployment locations, depth and estimated bottom locations

Site	Deployment Location		Drop Date	Time (UTC)	Estimated Location		Estimated Depth (m)
	Latitude	Longitude			Latitude	Longitude	
AEON1 NEC	42° 18.2148' N	065° 59.2542' W	2022 Jan 07	02:36	42° 18.2736' N	065° 59.3436' W	236
AEON2 ECS	42° 50.4498' N	066° 43.8768' W	2022 Jan 06	20:42	42° 50.4384' N	066° 43.8840' W	216
AEON3 GEB	42° 37.3482' N	068° 08.4378' W	2022 Jan 12	13:45	42° 37.3440' N	068° 08.4120' W	206
AEON4 JOB	43° 48.2280' N	067° 40.6140' W	2022 Jan 11	22:30	43° 48.2196' N	067° 40.5972' W	233
AEON5 WIB	42° 52.0302' N	070° 03.7968' W	2022 Jan 08	21:12	42° 52.0152' N	070° 03.7968' W	140

At AEON3 and AEON5, previously deployed landers were successfully recovered. Upon arrival to each station, the lander was first communicated with via the acoustic releases and range was established. If the range was acceptable, the landers were released from the anchor. Once the lander was spotted on the surface, the vessel approached the lander from the aft and was hooked via a snap hook line that led into the A-frame and to the winch. Once this connection was made, snap hooks tied to taglines were also secured to the uprights on the lander to assist in controlling the lander as it was retrieved. The lander was then brought on board over the open aft through the A-frame and secured for transit.

At AEON 4, range was established via the ranging function on the acoustic releases and both acoustic releases were triggered to release. Both releases confirmed they had released, but the lander did not ascend. After several further attempts to locate and release the lander, it was revealed that the lander was stuck to the bottom and further attempts at releasing the lander would be futile. On 17 Jan 2022 at 13:26 UTC a beacon message from the iridium tracking beacon installed on AEON4 was transmitted. A vessel was chartered to recover the drifting lander and was successfully retrieved on 20 January 2022 at approximately 20:30 UTC/15:30 EST (Figure 2).

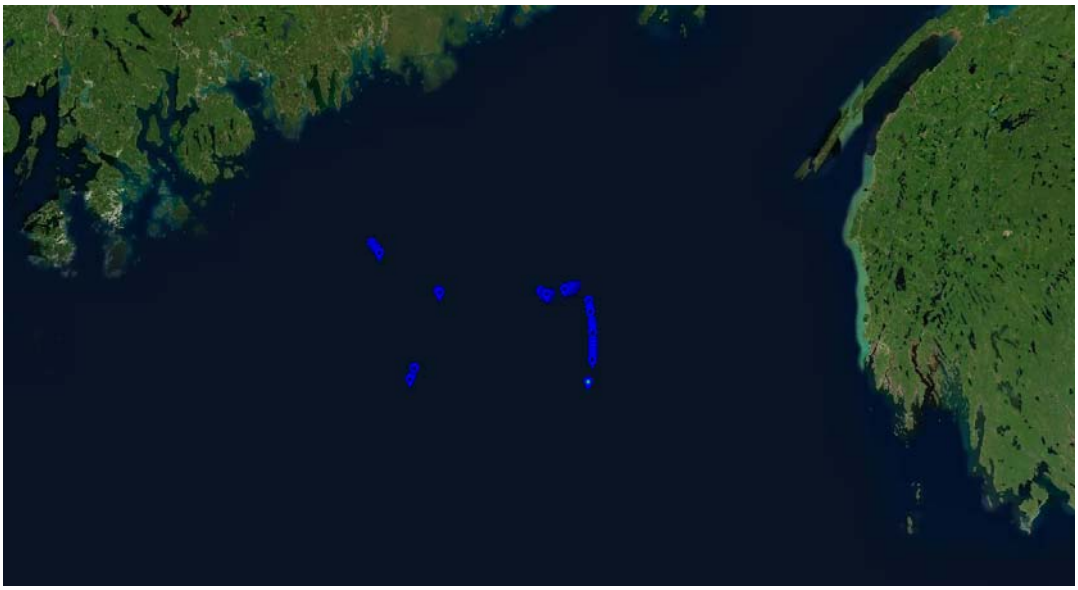

Figure 2. Beacon messages from Kilo 227 installed on the AEON4 lander deployed during the AEON-July 2021 cruise. The path shows initially the lander was moving North and then began moving South. Blue dots are position fixes. The blue dot with the green center is the location of recovery on Jan 20 at approximately 20:30 UTC.

Net Sampling

A 50 cm diameter (333 micron mesh) ring net was used to sample the zooplankton populations at four of the five AEON sites (Figure 3, Table 3). No ring net sampling was done at station AEON 2 (ECS) due to weather and time constraints. A vertical haul from 100 m depth was conducted although wind and currents resulted in typical wire-angles of ~ 30-45^{o} during the haul so the max depth sampled was likely less than 100 m. Samples were preserved on deck in a buffered seawater formalin solution and will be analyzed (identification and enumeration of taxa) post-cruise. The dominant organism in all

samples were copepods (various species), although chaetognaths, ctenophores, and krill were also present in some samples. An IKMT trawl was brought along on the trip but due to sea-state, weather, and time constraints it was not deployed during the trip.

Figure 3. Krill, gelatinous zooplankton, and copepods were all abundant in the C-01 cast at site NEC (left). Net processing was challenging due to a lack of a seawater hose and a very wet and cold deck during the transfer and preservation of samples (right).

Table 3. Ring net, CTD station, and fine-scale acoustic sampling activities conducted during the cruise. For an unknown reason, no data were recorded on the CTD instrument for cast C-04 (despite Joe being 100% sure he turned the instrument on). C=CTD cast, R=ring net tow, F=Fine-scale acoustic survey.

Date (UTC)	Time (UTC)	Lat (deg)	Lat (min)	Lon (deg)	Lon (min)	Site	Cast ID
2022-01-07	03:06:00	42	17.954	65	69.238	NEC	C-01
2022-01-07	03:13:00	42	18.014	65	59.226	NEC	R-01
2022-01-08	21:47:00	42	51.981	70	4.075	WIB	C-02
2022-01-08	21:59:00	42	51.851	70	3.961	WIB	R-02
2022-01-09	05:51:00 – 10:13:00	42	48.758	70	6.600	WIB	F-01
2022-01-11	20:58:00	43	48.472	67	40.769	JOB	C-03
2022-01-11	21:07:00	43	48.247	67	40.724	JOB	R-03
2022-01-12	12:53:00	42	37.945	68	7.835	GEB	C-04*
2022-01-12	13:02:00	42	38.2	68	7.68	GEB	R-04

CTD Sampling

A SeaBird 19+ CTD was deployed to a depth of 100 m at each station (Table 1), although similarly to the ring net wind and currents often resulted in a 30^{o} wire angle on the deployment. Maximum depths sampled varied between 50 and 85 m as a result of this. Both the CTD and ring net were deployed with a 35 lb clump weight to try to ensure that the instruments would be pulled straight down. However, the trawl line used on the vessel was very thick (probably 1" in diameter) which resulted in significant in-water drag during the deployments. For an unknown reason, no data were recorded on the SeaBird during cast C-04 (GEB site). This is despite Joe being 100% sure he turned the instrument on (and off) during that sample.

Fine-Scale Acoustic Survey

Again due to time sea-state and time constraints, there was only a single Fine-Scale Acoustic Survey conducted during the trip at the AEON 5 (WIB) site (Figure 4, Table 3). A small towfish was deployed off the starboard side of the vessel via the ship's crane at a tow depth of approximately 2 m. The towfish was equipped with a 38 kHz (split-beam, broadband), 120 kHz (split-beam, broadband), and 200 kHz (single-beam, broadband) transducers with EK80 wideband transceivers. A GPS puck was run through a mousehole on a conex shipping container on deck and the echosounders and data recording computers were set up inside the van. The van was not heated and one significant effect of this was that while the fine-scale survey was being done, the scientists monitoring the data breath exhalations would produce ice on the shipping container ceiling. This was concerning as if the weather warmed enough that those thawed then it would "rain" inside the container and on our electronics. So the echosounders and computers were covered with trash bags to try to prevent that from happening.

The survey design consisted of 5 parallel transect lines each 5 n.mi. long, however due to time constraints and cold conditions only four lines were surveyed. Survey speeds were ~ 4 kts and the sea state was fairly calm throughout the survey (waves 1-2 ft). Dolphins were observed next to the towfish several times during the survey, and their vocalizations were heard inside the vessel's berths as well as appearing on some of the echosounder recordings as "noise".

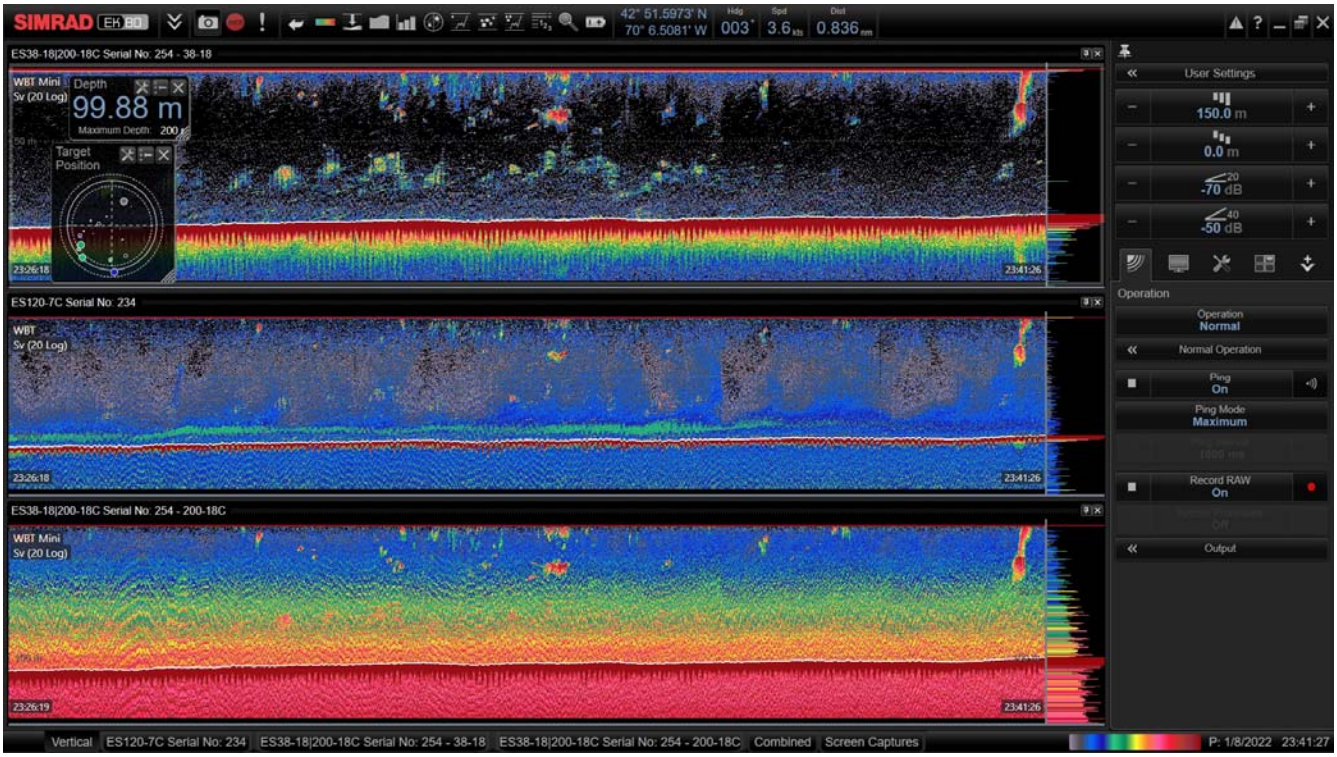

Figure 4. Screenshot of the echogram during the fine-scale acoustic survey conducted at AEON 5 (WIB). Near bottom diffuse scattering layer (blue streak) can be seen in the 120 kHz echogram (middle), while fish aggregations (red blobs) were also observed by all three echosounder frequencies.